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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/726,638
Filing Date: December 04, 2003
Appellant(s): KU ET AL.

John A. Castellano
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 02/09/09 appealing from the Office action mailed 07/03/08.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal (note that co-pending application number 11/148,301, cited by applicant, is not currently under appeal).

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2005/0176247	Cabral, Jr. et al.	8-2005
6,846,734	AMOS ET AL.	1-2005
6,498,080	CHITTIPEDDI ET AL.	12-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 7-9, 15-18, 26, 28-29, and 31-34 are rejected under 35 U.S.C. 102(e) as being anticipated by Cabral, Jr. et al., U.S. 2005/0176247.

Cabral, Jr. et al. shows the invention as claimed including a method of forming a nickel silicide layer on an exposed silicon surface comprising: depositing a nickel alloy

layer on the exposed silicon surface, the nickel alloy including nickel and an alloying metal that constitutes no more than about 10 atomic percent of the nickel alloy (see paragraphs 0036-0039); reacting the nickel alloy layer with the exposed silicon surface to form a nickel silicide layer having an upper layer and a lower layer, wherein the alloying metal is preferentially segregated in the upper layer (note that this will inherently be the case since the alloying element composition will be substantially similar to that of the instant invention).

Concerning claims 2-3, 16-17, and 33-34 note that inherently these compositions will follow since the alloying elements are substantially similar compared to the instant invention.

Regarding claims 4 and 18, note that the nickel and silicon are present in the lower layer in an atomic ratio of about 1.

Concerning claims 7-9, note that the alloying metal can be tantalum in the claimed composition (see, for example, abstract and figs. 4-6).

With respect to claims 31-32, the layer is nickel monosilicide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cabral, Jr. et al., U.S. 2005/0176247.

Cabral, Jr. et al. is applied as above but does not expressly disclose the particular processing parameters of the silicidation. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum silicidation temperature and time based upon a variety of factors including the desired thermal budget and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

Claims 5-6, 10-14, 19-20, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabral, Jr. et al., U.S. 2005/0176247 as applied to claims 1-4, 7-9, 15-18, 26, 28-29, and 31-34 above, and further in view of Amos et al., U.S. Patent 6,846,734.

Cabral, Jr. et al. is applied as above but does not expressly disclose a capping layer of titanium nitride formed over the nickel alloy prior to reaction and then removed after the reaction.

Amos et al. discloses forming a capping layer of titanium nitride 60 on the nickel alloy before reacting the nickel alloy with the exposed silicon, where the nitrogen:titanium atomic ratio is at least 0.5 (see fig. 13 and col. 9-line 10 to col. 10-line 34). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Cabral, Jr. et al. so as to form a titanium nitride capping layer as disclosed by Amos et al. because the capping layer prevents unwanted impurities from entering the nickel alloy layer during reaction.

Claims 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabral, Jr. et al., U.S. 2005/0176247 as applied to claims 1-4, 7-9, 15-18, 26, 28-29, and 31-34 above, and further in view of Chittipeddi et al., U.S. Patent 6,498,080.

Cabral, Jr. et al. is applied as above but does not expressly disclose forming a gate capping layer on the gate electrode to protect an upper surface of a polysilicon layer included in the gate electrode and exposing silicon surfaces only on the gate electrode while covering the source/drain regions with an insulating layer.

Chittipeddi et al. discloses exposing silicon surfaces on the gate electrode 15 while covering the source/drain regions with an insulating layer 57 (see fig. 12) or forming a gate capping layer 17 on the gate electrode to protect an upper surface of a polysilicon layer included in the gate electrode (see figs. 8-9), exposing portions of the

semiconductor substrate in a source/drain region formed in the active region and exposing a silicon surface on the gate electrode. In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Cabral, Jr. et al. so as to include the silicidation processes of Chittipeddi et al. because this allows for greater flexibility in the process since the gate and source/drain regions do not need to be all silicided or all silicided from the same material.

(10) Response to Arguments

Examiner has Failed to Establish Inherency

Appellant argues that a case of inherency has not been made by the examiner with respect to the Cabral, Jr. et al. reference, US 2005/0176247. However, the examiner respectfully submits that Cabral, Jr. et al. discloses embodiments including the claimed alloying elements in the claimed compositions and therefore it would be expected that a similar result would be achieved with the reacting process step, particularly since the temperature range of the reacting step of 250-600 Celsius in the Cabral, Jr. et al. reference (see paragraph 0045) is substantially the same or at the very least is contained within the temperature range of 200-700 Celsius in the reacting step of the instant application (see paragraph 0016 of the instant application). Appellant has not provided any evidence or reasoning as to why elements of substantially the same composition when heated at substantially the same temperature would not produce the results as claimed in the instant application.

For at least the same reasons as applied to the above claims, the examiner respectfully submits that the rejection of claims 15-34 are also believed proper.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,
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